

Claims

1. A gas cooling type vacuum heat-treating furnace incorporating a gas cooling furnace for cooling an article  
5 which has been heated, with pressurized circulation gas, characterized in that

the gas cooling furnace comprises a cooling gas surrounding a cooling zone where the article to be heat-treated is stationarily set, and defining therein a vertical gas passage having a constant cross-sectional area, a gas cooling and circulating device for cooling and circulating gas vertically flowing in the cooling chamber, a gas direction switching device for switching directions of gas vertically flowing in the cooling chamber, and  
10 upper and lower straighteners blocking upper and lower ends of the cooling chamber, for causing a flowing velocity distribution of the gas passing therethrough to be uniform.

2. A gas cooling type vacuum heat-treating furnace  
20 as set forth in claim 1, characterized in that each of the upper and lower straighteners comprise a uniform distribution portion and a straightening portion which are stacked one upon another, or have both functions of a uniform distribution portion and a straightening portion,  
25 the uniform distribution portion has a plurality of pressure loss inducing means uniformly arranged in a direction orthogonal to an upward gas stream, for applying

a flow resistance corresponding to a pressure loss coefficient of not less than 0.1, to the upward gas stream so as to aim at uniformly distributing flow velocities, and

5       the straightening portion has a plurality of straightening grids for straightening flowing directions of the upward gas stream having passed through the uniform distribution portion.

10       3. A gas cooling type vacuum heat-treating furnace as set forth in claim 1, characterized by further comprising auxiliary distribution mechanisms for guiding directions of gas streams flowing into the cooling chamber upward and downward from the gas direction switching device.

15       4. A gas cooling type vacuum heat-treating furnace as set forth in claim 1, characterized in that

20       the gas cooling and circulating device comprises a cooling fan arranged adjacent to the cooling chamber, for sucking and pressurizing the gas having passed through the cooling chamber, and a heat-exchanger for indirectly cooling the gas sucked in to the cooling fan, and

25       the gas direction switching device incorporates a hollow cowling surrounding the heat-exchanger, being spaced therefrom, and an elevating cylinder for moving the cowling up and down, the cowling has a lower suction port which is communicated with a lower part of the cooling chamber at a downward position, and an upper suction port

which is communicated with an upper part of the cooling chamber at an upward position.

5. A cooling gas direction switching device in a gas cooling type vacuum heat treating furnace incorporating a  
cooling chamber surrounding a cooling zone in which an article to be heat-treated is stationarily set, and a gas cooling and circulating device for cooling and circulating gas passing through the cooling chamber, the heat-treating furnace being adapted to cool the heated article to be  
10 heat-treated with pressurized circulation gas,

characterized by a stationary partition plate partitioning between the cooling chamber and the gas cooling and circulating device, and a rotary partition plate which is rotated along an outer surface of the  
15 stationary partition plate, and

characterized in that the stationary partition plate has an opening passing therethrough over the entire surface thereof, the rotary partition plate having a suction opening and a discharge opening which are partly  
20 communicated with a suction port and a discharge port of the gas cooling circulation device, whereby directions of the gas passing through the cooling chamber are alternately switched.

6. A gas direction switching device in a gas cooling type vacuum heat treating furnace as set forth in  
25 claim 5, characterized in that the cooling chamber has a gas passage vertically piercing therein, and an opening

position is set in such a way that:

when the gas flows downward in the cooling chamber,  
the suction opening is communicated only with a lower part  
of the cooling chamber while the discharge opening is  
5 communicated only with an upper part of the cooling  
chamber, and

when the gas flows upward in the cooling chamber,  
the suction opening is communicated only with the upper  
part of the cooling chamber while the discharge opening is  
10 communicated only with the lower part of the cooling  
chamber.

7. A gas direction switching device in a gas cooling  
type vacuum heat treating furnace as set forth in claim 5,  
characterized in that an opening position is set in such a  
15 way that:

when the gas vertically flows in the cooling chamber,  
the suction opening is selectively communicated only with  
a lower part or an upper part of the cooling chamber while  
the discharge opening is selectively communicated only  
20 with the upper part or the lower part of the cooling  
chamber, and

when the gas horizontally flows in the cooling  
chamber, the suction opening is selectively communicated  
with only one of opposite sides of the cooling chamber  
25 while the discharge opening is selectively communicated  
with only the other of the opposite sides of the cooling  
chamber.

8. A gas direction switching device in a gas cooling type vacuum furnace as set forth in claim 5, characterized in that the gas cooling and circulating device comprises the a cooling fan arranged adjacent to the cooling chamber,  
5 for sucking and circulating the gas having passed through the cooling chamber, and a heat-exchanger for indirectly cooling the gas discharged from the cooling fan.